Big Sky Clearwater

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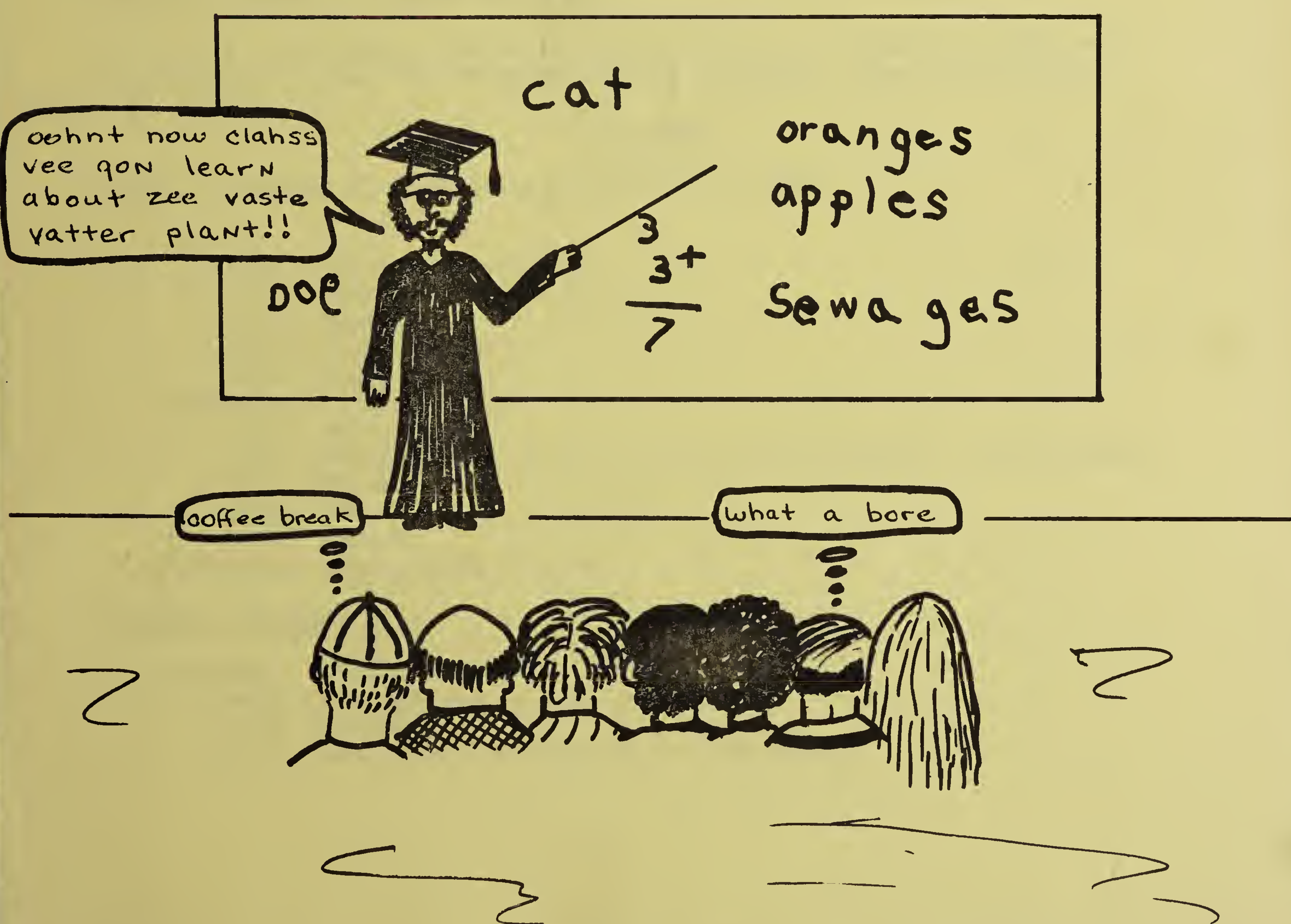
45th Annual Water School



WATER SCHOOL

The Forty-Fifth Annual School for Water and Wastewater Operators and Managers is scheduled for November 13 to 17.

This year the school will be geared toward the operator. The presentations will be applicable to the day to day operation of water and wastewater treatment plants. Hopefully, no one will feel that the information presented is going "over their heads". All comments received after the last school were taken into consideration and the result is a school that we feel everyone will be happy with.

This year the two principle speakers are John D. O'Connor and James M. Dornbush. Mr. O'Connor is chairman of the Department of Civil Engineering at the University of Missouri-Columbia. He is an internationally known authority on iron and manganese removal. He has authored several chapters in the AWWA publication "Water Quality and Treatment". Mr. O'Connor is presently involved in studying energy use in wastewater treatment plants and water degradation in distribution systems. He will speak on the latter.

James M. Dornbush comes to the school at Bozeman from South Dakota State University at Brookings. He is a professional engineer and a full professor at State. Currently he and his students are involved with some infiltration and percolation studies. He will be speaking on facultative oxidation ponds and land disposal of lagoon effluent.

The cost for the school will be $45.00 per person. An added bonus this year will be a free prime rib luncheon on Friday afternoon. See you all there!

Schedule

Monday - November 13 (Registration from 8:00 to 1:00)

Morning
- 8:00 - Pre-school Workshop
- 8:30 - Basic Math and Hydraulics
- 10:00 - Break
- 10:30 - Basic Chemistry
- 12:00 - Lunch

Afternoon - Joint Session
- 1:30 - Welcome
- 1:45 - Water Quality Changes in Distribution Systems - John O'Connor
- 3:00 - Break
- 3:30 - John O'Connor (Continued)
- 5:00 - Adjourn
- 7:00-9:00 - Special Help Sessions

Tuesday - November 14

Morning - Water Operators
- 8:00 - Distribution Systems - Ken Johnson
- 9:30 - Break
- 10:00 - Backflow/Cross Connections - Bob Clapper

Morning - Wastewater Operators
- 8:00 - Treatment Modes - Tim Hunter
- 9:30 - Break
- 10:00 - Operator Serves as Integral Member of Plan and Design Team Tim Berry
- 11:30 - Lunch

Afternoon - Joint Session
- 1:00 - Operation of Facultative Oxidation Ponds - James Dornbush
- 2:30 - Break
- 3:00 - Land Disposal of Lagoon Effluent - James Dornbush
- 4:30 - Chlorination Workshop
- 5:30 - Adjourn

Evening
- 7:00-9:00 - Special Help Sessions

Wednesday - November 15

Morning - Joint Session
- 8:00 - Microbiology for Water and Wastewater Operators - Millipore Corporation, Stuart McMillan
- 9:30 - Break
- 10:00 - Microbiology Workshop
- 11:30 - Lunch

Afternoon - Water Operators
- 1:00 - Taste and Odors - Bill Fielder
- 2:30 - Break
- 3:00 - Disaster Response - Dayton Alsaker

Afternoon - Wastewater Operators
- 1:00 - Activated Sludge - Bog Hegg
- 2:30 - Break
- 3:00 - Activated Sludge (Continued)
- 4:00 - (Joint Session) - Round Table Discussion on Violations - Art Clarkson, Moderator
- 5:00 - Adjourn

Evening
- 7:00-9:00 - Special Help Sessions

Thursday - November 16

Morning - Joint Session
- 8:00 - Pumps - Kutzman
- 9:30 - Break
- 10:00 - Disinfectants: Advantages and Disadvantages - Steve Potts
- 11:30 - Lunch

Afternoon - Water Operators
- 1:00 - Wells and Groundwater
- 2:30 - Break

Afternoon - Wastewater Operators
- 1:00 - Extended Aeration Package Plants - Chuck Harper
- 2:30 - Break
- 3:00 - (Joint Session) - Microbiology Workshop - Millipore Corporation
- 4:00 - (Joint Session) - Workshop: Cl_2, Math, Chemistry
- 5:00 - Adjourn

Evening
- 7:00-9:00 - Special Help Sessions

Friday, November 17

Morning - Joint Session
8:00 - Cost Effective Plant Operations, Panel Discussion - Dan Frazer, Moderator
9:30 - Break
10:00 - Electricity - Ralph Shirley
12:00 - Free Lunch and Awards
1:30 - School Adjourns

P.S.: The panel discussion at 8:00 on Friday morning will be much more meaningful if all of the operators will try to think of ways you personally have cut down on costs in the operation of your plants. For example, turning off unnecessary lights or equipment, preventive maintenance, proper chemical dosages, etc. We would like to see everyone contribute and become involved.

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NEW OPERATOR EMPLOYMENT SERVICE

After November 1, the Water Quality Bureau will be starting an employment service for water and wastewater operators. Operators seeking employment or cities seeking operators may now call Rosemary Fossum at 449-2691. She will relay information to interested parties.

Except for Big Sky Clearwater, there has not been a method of effective communication between prospective employees and employers. We hope this clearinghouse type of service will prove helpful.

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IN MEMORIAM

Louvill "Lou" F. Garske, 52, of Great Falls, died Sunday evening, October 8, in a Great Falls hospital.

Born in Cut Bank, he grew up and received his education there. He graduated from high school there and received a degree in forestry from the University of Montana.

He served in the Navy during World War II. In 1966 he married Jeanne Tepe in Great Falls.

For the past 28 years he worked for the City of Great Falls as an engineer.

He was a member of the Montana Licensed Land Surveyors, the American Water Works Association, the American Public Works Association, the Certified Senior Engineering Technicians, the Institute for Transportation for Municipal Engineers and the Elks Club. Mr. Garske was also secretary-treasurer for the Montana Water Pollution Control Federation.

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WATER QUALITY BUREAU STAFF CHANGES

Alf Hulteng who has served as the Billings branch office manager for the Water Quality Bureau since 1969 has resigned to enter the construction business in Billings. Prior to working for the State, Alf worked for McLaughlin Construction Company as a construction superintendent. It seems that Alf has not lost his "love" for construction. We are sure his smile (also his bald head) will be missed by those he worked with in Eastern Montana.

Jim Brown who has headed up the wastewater discharge permit program since 1973 has transferred to Billings to replace Alf. Jim is a native of South Dakota and has a graduate degree in environmental health engineering from the University of Texas.

Bob Braico has replaced him in the permit program. Bob formerly was responsible for plan and specification review at the Helena office and served as regional engineer for the central part of the state. Bob has worked for the Bureau since 1972 and has a graduate degree in environmental engineering from Montana State University.

Jim Melstad has moved from the Subdivision Bureau to the Water Quality Bureau. Jim is also a native of South Dakota and has a master's of science degree from South Dakota State in agricultural engineering with emphasis on environmental engineering.

John Jarvie has replaced Richard Karp and is responsible for data handling and stream modelling. Richard has started his own company in Helena and will still be in the data handling and assessment business. John is a native of Montana, has a Ph.D. degree in physical chemistry and has been actively involved with computer processing of data. He has most recently worked with the Department of Natural Resources and Conservation.

Roy Wells who formerly worked with the Middle Yellowstone Areawide Planning Organization in Billings and most recently with the Bureau at its Billings branch office has transferred to Helena to work on the construction grants program. Roy is a native of Montana and received a graduate degree in sanitary engineering following employment in the aerospace industry.

Scott Anderson who graduated in civil engineering in 1978 from the University of Idaho will also be working on the construction grants program. Scott is a native of Idaho and replaces Keith Brown who resigned some time ago.

Tim Hunter is the most recent addition to the Bureau staff. Tim has a degree in natural resources from Colorado State University and has worked for the past two years at the Upper Thompson Sanitation District at Estes Park, Colorado, which has been conducting experimental work on innovative sewage treatment processes. Tim will be working with the construction grant and operator assistance programs.

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WATERBORNE DISEASE IN MONTANA
By Jim Melstad
Water Quality Bureau

Positive identification of the source of a disease which is believed to be waterborne is usually difficult. There are numerous reasons for this, i.e., inadequate reporting of disease, water sampling conducted after contamination has passed, lack of adequate testing, etc.

Montana has had disease outbreaks where drinking water was the likely source of contamination. Probably the most well known case was a gastroenteritis outbreak at a Montana ski resort in December of 1974 and January of 1975. Approximately 750 became ill with the disease. A cracked water line connection near the well and poor surface drainage away from the well casing was the suspected cause of contamination. Subsequent repairs and chlorination eliminated the problem.

More recently, an infectious hepatitis outbreak in the South Libby Flats area near Libby was reported. The outbreak began in December of 1977 and approximately 50 cases were finally reported from primary or secondary infection. The South Libby Flats area has many septic tank-drainfield installations and shallow wells on small lots. This undesirable situation is worsened by seasonal high groundwater conditions and was believed to be the cause of the disease. The hepatitis outbreak was not the first in the area and it now appears that a public sewage collection system will soon be constructed.

There are many other instances of disease in Montana where water was the suspected vehicle of infection. Most of these cases affected a small number of people and are much too numerous to mention here. Hopefully, cases which were mentioned here help to illustrate that people still get sick from drinking water. This is in spite of our advanced technical knowledge and volumes of laws and regulations. The most valuable knowledge obtained from the study of waterborne disease is learning how to prevent the problem. More emphasis should be placed on reporting the instances of disease and on the subsequent investigations.

There are also other recent instances where water was the suspected vehicle of infection:

1) Recent samples taken from a small community water system near Great Falls showed coliform contamination. Water had to be boiled or disinfected until the problem was corrected.

2) An infectious hepatitis outbreak began in the Kalispell area in November, 1977. Several of the cases had a common water supply although the source was never isolated. The outbreak was not as extensive as the Libby outbreak.

3) Between October, 1977, and February, 1978, 15 cases of gastrointestinal illness were reported in Gallatin County. The causative agent was determined to be the Giardia species of protozoa which can be waterborne.

4) Five to ten cases of Giardia lamblia were reported by rumor in the summer of 1977 at White Sulphur Springs. Well water was the suspected cause.

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OPERATOR CERTIFICATION CORNER

Sample Certification Test Questions

1) A flow of 6 mgd of wastewater enters a plant with six aeration tanks 100 X 20 X 20 feet. What is the detention time in the aeration tanks in hours?

2) A well pump has to pump 1000 gpm into the city water supply. The pressure at the pump when pumping is 50 psi. What horsepower motor will it take to run this pump at 65 percent efficiency?

3) How many pounds of a chemical must be added to 50,500 gallons of water in order to produce a dosage of 75 mg/1?

4) It is desired to have a chlorine residual of 0.5 mg/1 in wastewater having a chlorine demand of 6.4 mg/1. What is the required chlorine dose?
(a) 0.5 mg/1 (b) 1.0 mg/1 (c) 6.45 mg/1 (d) 6.9 mg/1 (e) 5.9 mg/1

5) A six-inch pipe is flowing at a velocity of six feet per second. What is the flow in gpm.

Answers

1) To get detention time use the formula:

$$dt = \frac{\text{volume of tank(s)}}{\text{flow}}$$

volume of tanks = 100 feet X 20 feet X 20 feet X 6 tanks
= 240,000 feet^3
then 240,000 $\cancel{ft^3}$ X 7.5 gal/$\cancel{ft^3}$ = 1,800,000 gal
flow = 6 mgd or 6,000,000 gal/day

$$\text{so } dt = \frac{1{,}800{,}000\ \cancel{gal}}{6{,}000{,}000\ \cancel{gal}/day} = .3 \text{ days}$$

and .3 $\cancel{days}$ X 24 hrs/$\cancel{day}$ = 7.2 hrs.

2) To solve for horsepower, use the formula:

$$hp = \frac{\text{gpm X head (ft.)}}{\text{3960 X eff\%}}$$

first find feet of head using the formula:

PSI X 2.3 = Head (ft.)

50 psi X 2.3 = 115 feet

then $hp = \frac{1000 \text{ gpm} \times 115 \text{ ft}}{3960 \times .65}$

hp = 42

3) Use the formula: (note ppm = mg/l)
and 50,500 gal = .05 million gal
lbs = mg X 8.34 X ppm
lbs = .05 X 8.34 X 75
lbs = 31

4) Answer D is correct - 6.4 mg/l is used up in chlorine demand, so the dose will have to be 6.9 mg/l to leave a 0.5 mg/l residual.

6.4 mg/l
0.5 mg/l
6.9 mg/l

5) Use the formula Q = V X A where Q = flow (cfs)
V = velocity (ft/sec)
A = area (ft^2)

The formula for the area of a circle is $A = \pi R^2$
pipe radius is 3 inches or .25 ft

$A = \pi R^2$
$A = 3.14 \times .25^2$
$A = .2 \text{ ft}^2$

and V is given as 6 ft/sec

so Q = A X V
$Q = .2 \text{ ft}^2 \times 6 \text{ ft/sec}$
$Q = 1.2 \text{ ft}^3\text{/sec}$

now convert to gallons per minute

$1.2 \cancel{\text{ft}^3}/\cancel{\text{sec}} \times 7.5 \text{ gal}/\cancel{\text{ft}^3} \times 60 \cancel{\text{sec}}/\text{min} = 540 \text{ gpm}$

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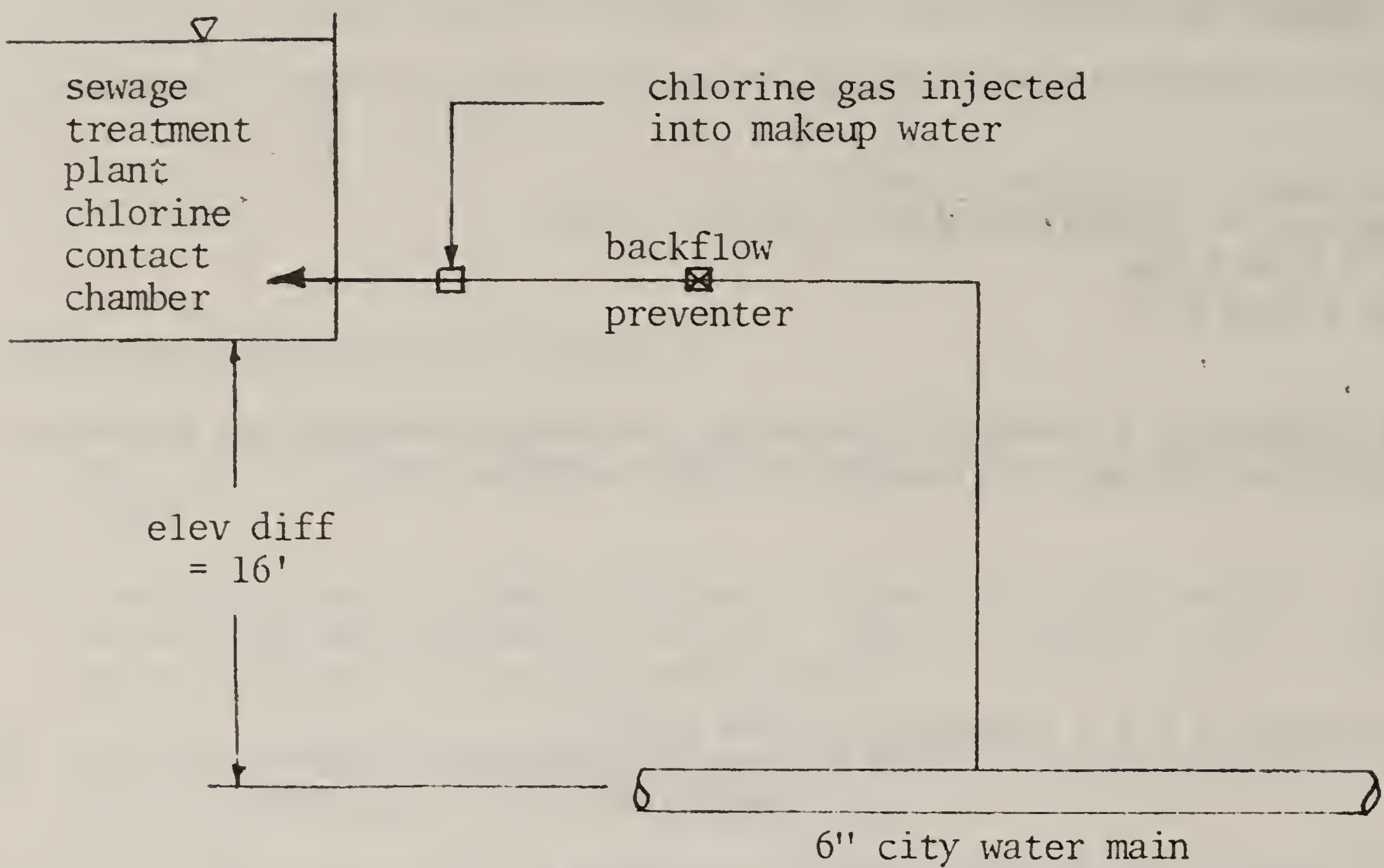
OPERATOR'S REPORT OF LOLO INCIDENT



Sequence of events:

1. City water main was emptied.

2. Backflow preventer (check valve) did not close.

3. Resulting vacuum and/or elevation difference plus check valve failure allowed sewage treatment plant to flow into city's water main.

Ed. note:

The above occurred when a 6" main was temporarily taken out of service at Lolo. There was no back-up for the failed check valve (a second check valve is recommended). Following is an article by David Haverfield, the Lolo system operator.

DANGER! CROSS-CONNECTION!
By David Haverfield

The Missoula County Rural Special Improvement District No. 901 (Lolo Sewer and Water) narrowly averted potentially serious contamination. The small, incorporated town of Lolo (population 4,200) is growing rapidly, especially in the RSID because of the water and sewer services available. The incident occurred as a new subdivision was being connected to the system close to the sewage treatment plant.

At the plant, chlorine is injected into the contact chamber with makeup water from the municipal supply. The treatment plant sits above the ground 16 feet high.

I was at the job site observing the connection to the new subdivision when I noticed a small trickle of wter from the main that never seemed to stop. Back siphonage was suspected. After checking the sink faucet at the plant and finding chlorinated effluent coming out (a positive indication of a partial backflow), both county and state Departments of Health were contacted immediately.

Art Clarkson in Helena quickly computed a proper dosage of calcium hypochlorite and detention time needed for proper disinfection of the water mains. He also directed that an adequate backflow prevention device be installed with the added order that all residences be contacted. This was speedily done with the help of the Volunteer Fire Department. Normal service resumed after adequate flushing of the mains took place.

Could this have happened to your system? What other types of cross-connections are there?

No water main should be shut down except for emergency or main repair. In Lolo no mains are shut down for residences or businesses unless approved by the Board of Trustees (RSID No. 901). Since this rule, incidents of contractor and excavator damage has dropped off as they must shut off the service line at the curb box or corporation stop at the main.

One of the major factors of keeping distribution mains and service laterals free from contamination is the pressure inside the pipe is greater than that of the outside. There are occasions when this pressure is lowered or a vacuum is created. This may occur when a fire hydrant is operated, over irrigation or under-sized mains are used, or the obvious - the main valve is shut off. It is at this time that an illegal cross-connection may show up.

What is an illegal cross-connection? An illegal cross-connection is any potable water supply connected directly to any nonpotable source. It can be as simple as a hose laying in a lawn in a puddle of water or as complicated as lubricating water to a pump with mechanical seals, or as common as a connection to a chemcial mining tank.

We, as operators, are responsible to our public (and ourselves) for our potable and nonpotable supplies.

What can you do to prevent a disaster? Check your plant and other public buildings, don't forget hospitals, inform your public, educate them of the hazards. Begin now! What will you do today that is more important?!

Free pamphlet: Watts Regulator Company, Lawrence, Massachusetts 01842, No. F-50

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DDT IN WATER SUPPLY

(Reprinted from the Official Bulletin of the North Dakota Water and Pollution Control Conference)

It's impossible! Something like that could not happen to our water supply system, but it did in Kulm, North Dakota in the month of June this year. A back siphonage resulted in a DDT contamination of the Kulm water supply.

The first hint of trouble was complaints to the mayor of an iodine taste in the water. The mayor noted the complaints were coming from specific areas, largely Main Street, in the southeast corner of town, and the northside of town. Becoming concerned, the mayor collected a bacterial sample and rushed it to Bismarck for analysis. He also notified the State Department of Health of the problem.

On the recommendation of the State Department of Health, the mayor approved calling in the National Guard to provide an alternate potable water supply until the taste was cleared up. An engineer from the State Department of Health traveled to Kulm to collect water samples and survey the system and symptoms. The engineer identified an iodine taste both on Main Street and in the southeast part of Kulm. The water left a burning sensation on the lips and throat for 10 to 15 minutes after being consumed. Kulm consumers reported the burning sensation along with minor stomach disorders and the iodine taste as symptoms they had noticed.

Over a period of three days the water distribution system was flushed eight times to remove the contamination. The State Department of Health again sampled the water supply and then authorized resumption of use of the system for human consumption after learning the taste had disappeared.

Laboratory analysis confirmed the presence of DDT at both locations where the engineer identified the iodine-like taste. A trace amount of DDT was also found in the sample taken after the repeated flushing of the system. However, none of the levels found were high enough to be toxic to man.

Back flow prevention and cross-connection control in Kulm was reviewed thoroughly. During the survey, two Kulm residents were found filling sprayers containing herbicide with garden hoses. The ends of the garden hoses were immersed in the herbicide water. The garden hoses had no back flow preventer, so that if a negative pressure developed in the water supply system, the herbicide water could be drawn into the Kulm water distribution system. This is apparently how the DDT was introduced into the system. Subsequent demands on the water supply system spread the DDT contamination in local areas. The source of the DDT has not been found, but the identification

of this banned substance complicates the incident. It is further assumed that the contamination of the system was a single occurrence. The sampling done by the State Department of Health was done after the fact, and levels of DDT could have been higher at the initial contamination time.

The main purpose of backflow prevention and cross-connection programs is to prevent connection of a nonpotable water supply to a potable water supply. Past case histories linked to back siphonage include contamination of water supplies with sewage, arsenic, river water, anti-freeze, chromate, and disease organisms which caused brucellosis, polio, gastroenteritis, salmonellosis, infectious hepatitis, and shigellosis. These past cases, along with the Kulm incident, point to the importance of cross-connection control programs through backflow prevention.

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CONSTRUCTION NEWS AROUND THE STATE

Lets have a look at who is building what and where. There is alot of activity around Montana. Water and wastewater treatment plants, water distribution and storage systems, and rehabilitation projects are popping up everywhere.

Wastewater treatment plant construction news is first. Hardin, Miles City, Stevensville, and Forsyth presently utilize lagoons for sewage treatment. These four communities have plans to complete oxidation ditches soon. Poplar and Colstrip have recently started up their new oxidation ditches. They are presently trying to work the "bugs" out of their systems. Livingston has only primary treatment at present. They have their sights set on a rotating biological disk to solve future wastewater treatment needs. Butte-Silver Bow Company is building a sludge pipeline and storage lagoon to complete the sludge handling portion of their plant. Havre East is in the process of constructing a collection system. They will hook onto the existing City of Havre system. The primary plant at Eureka will be upgraded to an aerated lagoon with land treatment of the lagoon effluent. Thompson Falls and Whitefish plan to upgrade their lagoons by converting them to aerated lagoons with the flexibility to go to phase isolation. Darby is adding an extra cell to their lagoon along with some piping that will enhance the flexibility of their facility.

The water treatment field is also busy in construction around the Big Sky country. Bozeman is considering addition of a new supply reservoir and possibly a filtration plant to supplement drinking water needs. Chester, Cut Bank, and Chinook have just put in new water treatment plants. Conrad is building a new direct filtration plant. Over in East Glacier they have formed a new water-sewer district. They are scheduled to start construction on a new water treatment plant and distribution system this fall. Nearby, Browning is adding some large Indian housing projects and they are going to have to increase the yield of their springs. Out in farm country, Carter, Galata, Floweree, and Oilmont have new rural water systems. Santa Rita is a new part of the Cut Bank North Water System. They get water from Cut Bank. Finally, Melrose is considering building a public water system.

There are probably a few we have missed here. Maybe we'll get a chance to tell you about them next time.

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SAFE DRINKING WATER STATE SURFACE IMPOUNDMENT ASSESSMENT

This project, more commonly known around the Water Quality Bureau as the "Pits, Ponds, and Lagoons Study", is underway and so far has resulted in an inventory of the location, size, and construction of Montana's municipal, industrial, and oil and gas impoundments containing liquid wastes. The inventory of the mining and agricultural categories remains to be completed.

A random sample from each category will soon be selected for evaluation of their pollution potential based upon hydrogeologic criteria.

Information will be gathered on monitoring activities and groundwater pollution cases for all Montana liquid waste impoundments.

The above information will be provided to the EPA as a part of their study of the magnitude of impoundment problems nationwide, along with Montana's recommendations on a program designed to protect against groundwater contamination from surface impoundments containing liquid wastes.

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FEASIBILITY OF A POST-COLLECTION STORAGE PERIOD IN DISSOLVED OXYGEN DETERMINATIONS

Richard Karp and Duane Klarich
Montana Water Quality Bureau
Billings Branch Office

INTRODUCTION AND METHODOLOGY

Dissolved oxygen (DO) and biological oxygen demand (BOD) are critical parameters in the assessment of aquatic systems. A low concentration of DO could be indicative of organic pollution and this condition is typically unsuitable for most forms of desirable aquatic animals. DO measurements are also used in the determination of BOD. BOD is a routinely monitored parameter for many wastewater operators. Occasionally an operator may be required to run DOs and/or BODs on the receiving stream. Therefore, the monitoring of DO is essential in many types of general surveillance work and wastewater treatment.

Standard Methods (14th Edition, 1975) lists several procedures for the determination of DO. A convenient and commonly used test is the azide modification of the iodometric or Winkler method which is currently being used by the Water Quality Bureau (WQB) of the Montana Department of Health and Environmental Sciences. This method is applicable to "... most sewage, effluent, and stream samples (Standard Methods, 1975)." Using the standard

BOD bottles, the azide modification is especially adaptable to work in the field through the use of chemical reagents in the form of prepared powder pillows, available, for example, from the Hach Chemical Company of Ames, Iowa (Hach, 1973). The procedure first involves the addition of a manganese sulfate ($MnSO_4$) powder pillow to a 300 ml water sample followed by adding the contents of an alkaline-iodide-azide (AIA) pillow; this results in a floc formation upon gentle agitation if oxygen is present in the water. Prior to a titration step, 2 ml of concentrated sulfuric acid (H_2SO_4) are added to the sample to release an amount of iodine (I_2) equivalent to the amount of DO tied-up in the original chemical complex (floc). The titration is them performed on a 200 ml portion with a 0.0250 N phenylarsine oxide (PAO) solution using the loss of a starch-I_2 coloration as the endpoint indicator. In this titration, one ml of PAO is equivalent to one mg/l of DO.

Both Standard Methods (1975) and WQB Field Procedures Manual (1974) suggest an immediate addition of reagent after sample collection with the titration step required within a few hours. However, considering time and equipment factors, titration within a few hours often is not feasible in the field or when a large number of water samples have to be collected. Three experiments were conducted to determine the possibility of a storage period between sample collection and titration by "fixing" the DO content of the water. This would allow the sample collector (operator, sanitarian or field technician) to transport the "fixed" water samples to the laboratory for analyses. A storage duration approaching two days would be desirable. In all three experiments, the water samples were collected from the Yellowstone River below Billings. Because of the presence of the Billings STP, this water is known to have a BOD.

RESULTS

Reviewing the reagent sequence of the above-described DO test, three possible combinations or cases were considered for "fixing" the DO content of a water sample:

Case 1. Fixation with $MnSO_4$ and AIA; or

Case 2. Fixation with $MnSO_4$ and AIA plus H_2SO_4.

Case 3. Nonfixation -- samples stored as collected.

These three cases were considered under three different temperature collection and storage conditions.

Condition 1. Warm sample - warm storage (23°C)

Condition 2. Cold sample (4.8°C) - warm storage (23°)

Condition 3. Cold sample - cold storage (4.0°C)

Condition 1 would approximate sample collection and field transport-storage under warm weather conditions, e.g. during the summer. Condition 2 would approximate the actual case of collecting and fixing cold water samples, as during the winter, but allowing them to warm in transport. Condition 3 would approximate the actual case of collecting cold water samples but transporting them under refrigerated condition, i.e., packed in ice.

Tables I through III show the experimental test results.

TABLE I

Warm Sample (23^{o}C) - Warm Storage (mg/l DO and percent of control:

Time (hours)	Control	Case 1	Case 2	Case 3
6.5	9.25 (100%)	9.30 (101%)	9.25 (100%)	8.90 (96%)
36.5	7.85 (100%)	7.90 (101%)	7.80 (99%)	7.70 (98%)
59	8.05 (100%)	8.05 (100%)	8.05 (100%)	7.50 (93%)
83	9.30 (100%)	9.30 (100%)	9.30 (100%)	8.85 (95%)
120	9.35 (100%)	9.40 (101%)	9.25 (99%)	--

TABLE IIA

Cold Sample (4.8^{o}C) - Warm Storage (mg/l DO and percent of control):

Time (hours)	Control	Case 1	Case 2	Case 3
24	10.10 (100%)	10.15 (100%)	10.15 (100%)	9.35 (93%)
48	10.10 (100%)	10.15 (100%)	10.20 (101%)	8.15 (81%)
72	10.10 (100%)	9.60 (95%)	7.60 (75%)	7.50 (74%)

TABLE IIB

Cold Sample (3.6^{o}C) - Warm Storage (mg/l DO and percent of control):

Time (hours)	Control	Case 1	Case 2	Case 3
24	13.00 (100%)	12.95 (100%)	12.85 (99%)	11.70 (90%)
48	13.00 (100%)	13.05 (100%)	12.80 (98%)	10.95 (84%)
73	12.95 (100%)	12.60 (97%)	11.65 (90%)	10.15 (78%)

TABLE III

Cold Sample (3.3^{o}C) - Warm Storage (mg/l DO and percent of control):

Time (hours)	Case 1	Case 2	Case 3
0**	11.85 (100%)	11.90 (100%)	12.05 (100%)
25	--	--	11.90 (99%)
48½	--	--	11.95 (99%)
50	11.85 (100%)	11.80 (90%)	--
60	11.90	--	--
63	11.90 (100%)	11.75 (99%)	11.85 (98%)
72	11.90 (100%)	11.75 (99%)	--

(** controls)

DISCUSSION AND CONCLUSIONS

These experiments indicate that the water samples have to be "fixed" for DO immediately after collection in order to avoid marked oxygen losses during prolonged storage. Some DO loss occurred within six hours without fixation (Table I), even in the sealed BOD bottles, due to the natural oxygen demand of the sample water. This loss with nonfixation was most distinct when the samples were allowed to warm (Table II), and it was least pronounced when the samples were kept chilled during storage (Table III). The best mode of fixation appears to be the $MnSO_4$-AIA floc complex with the acid addition completed just prior to titration. This procedure avoids an apparent I_2 loss that occurs when the storage period follows acidification; this feature was quite pronounced with increases in sample temperature (Table II). Using the $MNSO_4$-AIA fixation, these results suggest that DO samples can be stored for 72 hours and possibly up to 120 hours (Table I) with no major deviations from the control if large temperature increases are not anticipated. If increases in temperature are expected, storage for 48 hours only is indicated (Table II). If cold water samples, collected, for example, during the winter, have to be stored for longer than 48 hours, then provisions should be made to hold the samples under cold conditions (Table III). In turn, if it is not possible to fix a water sample for DO, these samples should also be stored in the cold, but for periods of less than 24 hours to avoid a biasing of the DO data.

The $MnSO_4$-AIA fixation apparently provides a substantial leeway for the collection of DO samples and their transport to the laboratory. The results of this study indicate that a storage period after fixation, as described, would not significantly alter the DO data but is still desirable to make the DO determination as soon after collection as possible.

LITERATURE CITED

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PROPOSED RULES FOR WATER HAULERS

The Board of Health and Environmental Sciences proposed to adopt a rule setting sanitation standards for haulers of water for human consumption. The purpose of the proposed rule is to assure the safety and purity of water hauled from a public water supply source to fill cisterns or other reservoirs to provide water for human consumption. EPA informed the state that water

haulers for cisterns were considered to be public water suppliers.

The definition of a water hauler is a person engaged in the business of transporting water to be used for human consumption from a water source to cisterns or alter reservoirs used by ten or more families or sixty persons for at least sixty days out of a calendar year.

The regulations set standards for equipment specifications, operation sanitizing, source of water, filling point construction and chemical treatment of the water.

Interested parties may get additional information, copies of the rules, or submit comments to the Water Quality Bureau, Department of Health and Environmental Sciences, Helena, Montana 59601 - telephone 449-2406.

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EPA GOES MOO

That's MOO as in Montana Operations Office. The office staff will ultimately number around twenty including staff level professional people in construction grants, planning solid waste, pesticides, energy, and enforcement. Primary reasons for establishing the office are to promote closer operating relations with state agencies and to reduce delays in review processes. The office director will have sign-off authority for commitment of federal funds. This means that EPA processing of grant requests for planning, construction, contract services, etc. will be handled in Helena.

Personnel assigned to the office at the present time include three who were already in Helena: Alan LeFohn - energy coordinator, Frank Stogsdill - pesticides and Dick Montgomery - enforcement. Others transferring from Denver are: office director - Ivan Dodson, water coordinator - Max Dodson (no relation), construction grants - Jim Boyter and Steve Potts, planning - Barbara Schroeder, air program - Tom Harris, solid waste - Bob Fox, and administrative assistant - Ann Doan.

Management and administrative sections of the office will be located in the new federal building. Some of the staff level people will also be in the federal building but those dealing directly with state staff people will be co-located within the state offices if space is available.

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STREAM DEWATERING

By Kit Walther and Loren Bahls, Ph.D.
Water Quality Bureau
Department of Health and Environmental Sciences

In Montana, the chief contributor to streamflow is the snowpack which accumulates in the mountain ranges. When this "pack" melts in the spring and early

summer, our streams receive the largest amount of runoff they will carry over a year's time. Into July, runoff is essentially completed and streams return to their normal based flows. Unless augmented by late summer rains or water storage, base flows are comparatively low. In many years, summer irrigation demands and other withdrawals exceed the low base flows, leaving numerous streams temporarily dry. Thus, the availability of water for both fish and human uses becomes a "feast or famine" situation.

The problem that results is one that most fishermen and irrigators know well: stream "dewatering", characterized by both an inadequate amount and quality of water to support a productive fishery or irrigation. In Montana, dewatering has been most noticeable in the Beaverhead, Bitterroot, West Gallatin, Big Hole, and Jefferson Rivers, but many other streams such as the Musselshall River are also affected.

Dewatering reduces instream flows needed to provide adequate dilution of industrial and municipal wastes. Potential beneficial water uses of several streams are impaired because of the combined effects of dewatering and waste discharges to surface waters.

The Department of Fish and Game, in a recent survey, reported fish populations being affected by excessive irrigation withdrawals on 285 stream segments of the 4700 miles surveyed. A separate survey by the Conservation Districts reported 837 miles of streams being affected by annual irrigation dewatering.

Irrigators and fishermen usually find themselves on opposite banks when discussing stream dewatering, even though both interest groups want reliable and adequate flows in our "dewatered" streams.

In an effort to portray the needs of the fisherman and irrigator and to serve as a point of departure for discussion, the Water Quality Bureau sponsored the production of a film documentary, "Man and Water". Produced by Tom Cook and Jim Nicoloro from Bozeman, the film explores the relationships between water quality and water quantity and their combined effects on instream and diverted water uses. In addition to examining the Big Hole River, the film outlines farming practices, ranching, and irrigation practices in the Big Hole Basin. The film also traces some of the area's history beginning with Meriweather Lewis's description of the Big Hole in 1805 as "bold, rapid, and clear". Depicting the dependence of man and fish on the river, the documentary acknowledges that change on the Big Hole is inevitable, but suggests that it should bear the mark of man's intelligence and creativity rather than the selfishness and carelessness that have ruined many other clear streams.

Although the film focuses on the Big Hole, its message has application throughout the state. It is hoped the film will increase local interest in those areas which experience chronic dewatering. Local interest groups are invited to view the film and call upon the Water Quality Bureau to discuss local dewatering problems. Water and wastewater treatment operators may find the film of interest and are welcome to view it or show it to community groups and city officials. The film may be obtained by contacting the Water Quality Bureau, Department of Health and Environmental Sciences, Capitol Station, Helena, Montana 59601. Telephone: 449-2406.

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